

the ornamentation it is more likely that *F. contrarium* was derived from a precursor of *F. perversum*, of which the modern spinose form of that species is the living representative. *F. contrarium* would, according to the speaker's judgment, be a side branch, and not in the direct line of ancestry. Some sinistral Miocene Fulgurs, after losing the primitive ornamentation, develop spines again on the rounded adult whorl, producing a form much like the modern typical *F. perversum*. A tendency similar to this has been noted in Miocene dextral shells of the non-canaliculate division *F. maximum*.

The abnormal specimen of *Fulgur canaliculatum* exhibited was found on the beach at Longport, New Jersey, on March 18, 1902, after a storm. Some accident occurring when the shell was young has caused it to grow so that the shoulder angle, so characteristic of the species, has disappeared, and we get a shell with a rounded whorl much like *Fulgur pyrsum* in appearance. The break in the shoulder occurred on a whorl which possessed the nodes characteristic of the earlier whorls of *F. canaliculatum*. After the break there is apparently an attempt to reproduce these nodes on the rounded surface of the whorl. The faint spiral ridge which occurs well over to the left on the last whorl has evidently been caused by another accident. On examining the soft parts of this specimen it appears to be identical with the normal male specimens, except that the shoulder angle is not present on the mantle.

On examining a normal male *Fulgur canaliculatum*, it will be seen that the backward folded penis lies directly under the shoulder angle. In the abnormal specimen the penis, as well as the other organs of the mantle cavity, all seem to be intact. The absence of the shoulder angle does not seem to be connected in any way with the underlying reproductive organ. It is interesting to note that the shoulder angle occurs equally well developed in the female of *F. canaliculatum*, though in this case it corresponds with no underlying organ. No peculiarity in the mantle edge or other soft parts of this abnormal specimen, accounting for the change in shell form and ornamentation which has occurred, had been discovered.

During the past winter, while searching for the young shells of our recent New Jersey Fulgurs, a series of *F. carica* was obtained which seems to exhibit sexual dimorphism. The adult males are all smaller than the adult females. Both males and females have about $6\frac{1}{2}$ -7 whorls, and show the adult characters of the swelling on the branchial siphon and the degeneracy of the spines on the last whorl.

Accounting for the Depth of the Wyoming Buried Valley.—MR. BENJAMIN SMITH LYMAN spoke on certain geological features of the Wyoming valley in Pennsylvania. It has long been matter for speculation and serious practical inquiry how the ancient Susquehanna valley, buried under glacial rubbish near Wyoming and

Wilkes-Barre, could be at least 110 feet deeper than the apparently lowest possible outlet of the same valley near Bloomsburg, and ninety feet deeper than the one near Sunbury, as pointed out by State Geologist Lesley in the *Pennsylvania State Geological Report G 7*, 1883, p. xv, and by Assistant Geologist Prof. I. C. White, at p. 26. Later, in the *Summary Final Report*, Vol. III, Pt. I, 1895, p. 2019, Assistant Geologist A. D. W. Smith gives a still greater depth recently found in the buried valley, at two miles below Wilkes-Barre, namely, 220 feet below the present Bloomsburg outlet, and 200 feet below the Sunbury one. The complete understanding of the buried valley in question is of the weightiest practical importance to the operators of the Wyoming anthracite basin; for the driving of coal mines unexpectedly into the glacial rubbish full of water has repeatedly caused loss of life and property, sometimes on a large scale. The consequent consciousness of danger and uncertainty about its conditions exact great caution; and, perhaps, the guarding against unknown possibilities may occasion great losses that might to some extent be avoided if only the circumstances could be better understood. Several theories have, therefore, been devised in explanation of the observed facts; but none have proved to be at all satisfactory. It has, for example, been suggested that the glacier itself, before retreating and leaving the rubbish, may have scooped out the valley to that depth. But Lesley and others have repeatedly pointed out how insignificant is and must be the erosive action of glaciers; and, furthermore, it appears highly improbable that a glacier could not only scoop out a deep valley, but carry the vast amount of eroded material over the lip of the basin. In this case, too, that lip, near Bloomsburg, is about twenty miles beyond the nearest point ever reached by the glacier. In 1883, Lesley, in the passage just cited, was momentarily persuaded that there was no escape from admitting that the result had been accomplished by "subglacial erosion—rivers beneath the ice sheet, charged with angular drift materials, plowing deep valley-grooves in the softer coal measures." But in the *Summary Final Report*, Mr. Smith states that Lesley "now regards his theory of subglacial erosion as wholly inadequate." Indeed, it would be hard to conceive how subglacial rivers could have maintained an erosive current at such a depth below the outlet of the valley. Mr. Smith cites the opinion of "at least one prominent mining engineer," that the buried valley "has no connected channel, but that the deep places are formed by a series of pot holes." It is true, pot holes are a subordinate glacial feature of the buried valley, and extend below its bottom forty feet or more into the coal measures, as described by Ashburner in the *State Geological Report for 1885*. But it is hardly conceivable that excavations on so grand a scale, as hundreds of bore holes have shown the buried valley to be, should have been effected, like pot

holes, by rapid currents of water carrying the materials comminuted by means of swiftly whirling pebbles quite beyond the limits of such enormously large hollows. The immensity of the currents required for such tremendous action is wholly inadmissible. It is hardly necessary to discuss the extravagant idea that the waters of the now buried valley escaped to the sea through some originally deep subterranean crevice or channel, now hidden farther than ever out of sight by the glacial accumulations. The idea has been resorted to merely from the absence of any other thoroughly plausible explanation, in view of the evident impossibility of hollowing out a valley and carrying off the excavated material over a distant border two hundred feet higher than the bottom. What seems, however, to be an extremely simple, natural and probable solution of the problem has hitherto been apparently altogether overlooked. The crumpling of the rock beds into folds by the contraction of the earth's crust in cooling must necessarily have been not a mere momentary movement, but in general an extremely slow one, continuing for many ages, perhaps, to be sure, intermittently, and may probably still be going on, even in some very ancient basins. A comparatively trivial amount of such action in the couple of hundred thousand years since glacial times would be ample to effect the observed results. For, if the Wyoming basin had thereby been depressed by only the wholly insignificant average amount of half a foot in a thousand years, and the rock saddles, or anticlinals, near Bloomsburg and Sunbury elevated at the same rate, the whole observed result would by this time be accomplished, and the old glacial valley would be found, as it is, a couple of hundred feet lower than those lowest present outlets. A liberal allowance, too, can easily be made for the degree to which those outlets have been eroded since the glacial action, and for the fact that they are not at the very summit of the anticlinals. Yet the movement would be a trifling one. In fact, the observed phenomena appear to be simply corroboration of what might with the utmost reason have been expected to occur; and the explanation is not by any means an arbitrary supposition of regional elevation or depression, conveniently imagined in order to suit facts apparently difficult to elucidate.

JUNE 10.

Mr. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Ten persons present.

Prof. Robert Collett, of the University of Christiania, was delegated to represent the Academy at the meeting commemorating the services of Niels Henrik Abel to mathematical science.